REMARKS/ARGUMENTS

Reconsideration and withdrawal of the rejections of record are respectfully requested.

Summary of Status of Amendments and Office Action

In the present amendment, the specification has been amended to update the status of the parent application in the manner suggested by the Examiner in the Office Action.

The claims have not been amended in the instant reply, and therefore this reply refers to the previously filed Listing of Claims. The Examiner is reminded that claims 1, 3-32 and 35 are pending in the application, with claim 1 being the only independent claim.

The Office Action rejects claims 1-3, 5-11, 31, 32 and 35 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,275,012 to Kokubo et al. (hereinafter "Kokubo").

The Office Action also rejects claim 4 under 35 U.S.C. 103(a) as being unpatentable over Kokubo in view of U.S. Patent No. 5,388,905 to Ake et al. (hereinafter "Ake").

The Office Action also rejects claim 12 under 35 U.S.C. 103(a) as being unpatentable over Kokubo in view of U.S. Patent No. 3,614,069 to Murry.

The Office Action also rejects claims 13 and 24 under 35 U.S.C. 103(a) as being unpatentable over Kokubo in view of U.S. Patent No. 2,543,055 to Pool et al. (hereinafter "Pool").

The Office Action also rejects claims 14-23 under 35 U.S.C. 103(a) as being unpatentable over Kokubo in view of Pool, and further in view of U.S. Patent No. 5,482,633 to Muldihara et al. (hereinafter "Muldihara").

The Office Action also rejects claims 25-30 under 35 U.S.C. 103(a) as being unpatentable over Kokubo in view of U.S. Patent No. 4,655,879 to Brockman et al. (hereinafter "Brockman").

Response to Rejections Under §103(a)

In response to the rejections set forth in the Final Office Action, Applicants respectfully submits the following:

Each of the rejections utilizes Kokubo, either alone or in combination, in rejecting the pending claims. Moreover, the rejections are basically repeated from the previous Office Action. Therefore, for the sake of brevity, Applicants are not repeating each of their arguments as presented in their previous response, but incorporate these arguments herein as if set forth in their entirety.

Applicants note that in the Response to Arguments section of the Final Office Action, the Final Office Action disagrees with Applicants' argument that Kokubo does not teach or suggest an apparatus in which the reaction section comprises a static mixer. In particular, the Examiner contends that, "The definition of a "static mixer" to one of ordinary skill in the art is a device in which fluids are mixed by means of flow past a stationary or fixed mixing element." Thus, the Examiner contends that as illustrated in Figures 3 and 4 and cited in column 4, lines 25-45 , Kokubo discloses a reactor comprising a static mixer, as reaction section (1) comprises a stationary or fixed mixing element in the form of a static partition panel 1 having opening 4, which the Examiner contends inherently provided additional mixing of the fluids upon accelerated flow the fluids through the restricted opening.

In response, Applicants respectfully submit that the interpretation of Kokubo as comprising a static mixer is without appropriate basis, and the rejection is therefore not adequately supported, and should be withdrawn. For example, Applicants note that the Final Office Action is only partially correct in defining a "static mixer" as comprising a device in which fluids are mixed by means of flow past a stationary or fixed mixing element. In this regard, Applicants do not contest that static mixers include flow past stationary of fixed mixing elements. However, a static mixer also does not have moving parts. In contrast, Kokubo includes a mixer including turbine blades 3' comprising 4 blades in each chamber which are rotated by the motor. Certainly, the mixing in Kokubo is dynamic, and there is absolutely no teaching or suggestion in Kokubo that the mixing can be achieved with a static mixer.

To assist the Examiner's understanding of static mixing as compared to dynamic mixing, Applicants submit herewith a copy of "Post Mixing Optimization and Solutions, printed from the Internet at http://www.postmixing.com/mixing%20forum/staticmix/static_mixers.htm on June 11, 2004. As can been seen from a review of this document, static mixers are different from traditional (dynamic) mixers because there are no moving parts. Still further, Applicants also include herewith a copy of Understanding Motionless Mixers obtained from the Internet at http://www.chemicalprocessing.com/Web_First/cp.nsf/ArticleID/DGRN-4QFQRM/ on June 11, 2004.[1]

1 The documents submitted with this response are submitted in accordance with MPEP 609(C)(3) as part of Applicants' reply to the Office Action in support of an argument so that the requirements of 37 C.F.R. 1.97 and 1.98 need not be met, and the information is being submitted as part of the record with the reply for the Examiner's consideration with Applicants' reply.

If the Examiner maintains this rejection, the Examiner is respectfully requested to support the rejection by providing documentary evidence to support the position that Kokubo discloses a static mixer. In this regard, Applicants submit that Kokubo discloses a dynamic mixer, and does not teach or suggest a static mixer as disclosed and claimed by Applicants.

Still further, the Examiner contends that Kokubo discloses a pump and a quantitative pump, and contends that the limitation of "high-pressure" provides no additional structural limitation to Applicants' disclosed pumping means, since the operational pressure of the pump is not an element of the apparatus, but a process limitation which is asserted to hold no patentable weight in apparatus claims.

In response, Applicants respectfully submit that a high pressure pump is a structural limitation that must be given weight in an apparatus claim. For example, one having ordinary skill in the art would readily understand that regular pumps are constructed and arranged to operate at lower pressures than high pressure pumps which are constructed and arranged to operate at lower pressures than ultra high pressure pumps. For example, regular pumps are constructed and arranged to operate with a pressure up to 40 or a maximum of 60 bar (4 or 6 MPa), high pressure pumps are constructed and arranged to operate with a pressure up to 200 bar (20 MPa), and ultra high pressure pumps are constructed and arranged to operate at 200-400 bar (20-40 MPa).

Moreover, the Examiner's attention is directed to the bottom of page 4 of Applicants' specification wherein it is disclosed that an advantage of the present invention is that the pressure at the beginning of transesterification can be up to 200 bar.

Still further, the Examiner's attention is directed to the enclosed page Pumping of Liquids and Gases, page 10-29, 1999 by the The McGraw-Hill Companies; 150J3W High Pressure Pressure Pump, downloaded from the Internet Site http://www.jetech.com/products/150j3w.asp on June 12, 2004; Model 600G3 High & Ultra-High Pressure Pump, downloaded from the Internet Site http://www.jetech.com/products/600_g3.asp on June 12, 2004; and Bran+Luebbe, NOVAPLEX pumps downloaded from the Internet Site http://www.spxprocessequipment.com/sites/branluebbe/global/eng/products/process/novaplex/html/novaplex.html under Data Sheet (Download PDF) on June 14, 2004. These documents show that one of ordinary skill in the art would recognize that a high pressure pumps are structured and arranged to be high pressure pumps, and that Kokubo does not teach or suggest a high pressure pump.

Regarding claim 4, Applicants once again respectfully submit that Ake is non-analogous art, and that one having ordinary skill in the art would not modify Kokubo with balls as taught by Ake. For example, as noted above, Kokubo discloses a mixer including turbine blades 3' comprising 4 blades in each chamber which are rotated by the motor turbines. One having ordinary skill in the art would not modify the structure of Kokubo to include balls therein, especially when such balls would be expected to interfere with the rotation of the turbine blades 3'.

Still further, there in no motivation for modifying Kokubo to include a reaction section comprising an ultrasound device. The rejection cannot merely point to isolated disclosure in Murry, and without any motivation to modify the structure disclosed in Kokubo.

Similarly, the rejections applying Pool, Muldihara and Brockman are without appropriate basis in that the rejections apply the isolated disclosures of the documents, but do supply adequate motivation for modifying Kokubo. In this regard, Kokubo is disclosed to be structured and arranged for continuous refining of oils and fats utilized the specific structure disclosed therein including the disclosed turbine mixers. Moreover, none of these documents overcomes the above-noted deficiencies of Kokubo even if for the sake of argument Kokubo is modifiable with any of their disclosures.

In view of the above, the rejections of record should be withdrawn and all of the claims indicated to be allowable over the prior art of record.

CONCLUSION

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the objections and rejections of record, and allow each of the pending claims.

Applicants therefore respectfully request that an early indication of allowance of the application be indicated by the mailing of the Notices of Allowance and Allowability.

Should the Examiner have any questions regarding this application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
N. ERGUN et al.

Reg. No. 33,094

Neil F. Greenblum
Reg. No. 28,394

June 14, 2004
GRENBLUM & BERNSTEIN, P.L.C.
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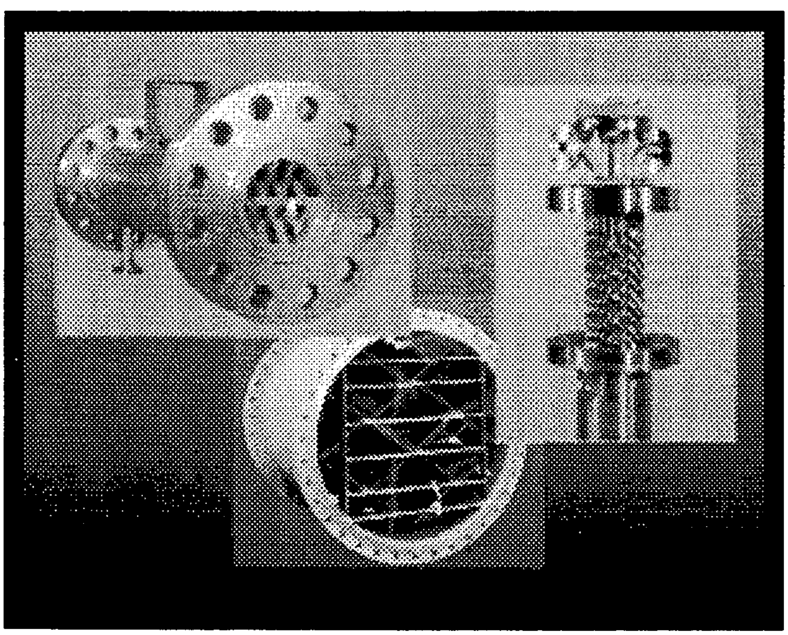
Static Mixers

[Up]

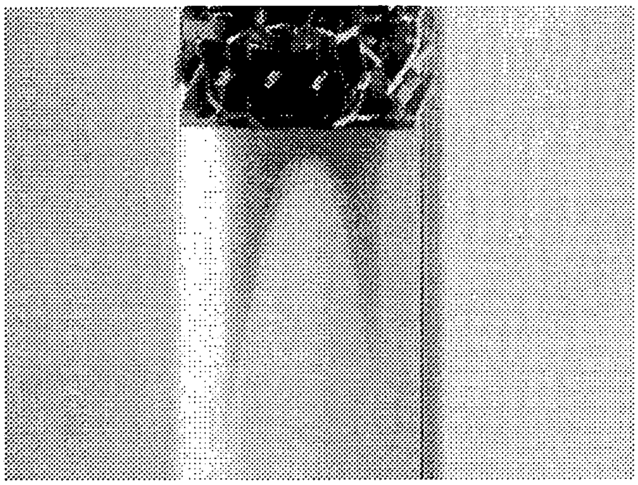


Static Mixers are different from traditional (dynamic) mixers because there are no moving parts. Most processes utilize pumps to transfer chemicals from one reactor to another. The static mixer contains plates or baffles in various shapes, which are attached to the pipe and are therefore stationary. As the fluids are pumped by these obstacles, turbulence and the physical shifting of the fluid elements causes the fluids to mix. Here is a video (courtesy of Sulzer Chemtech) that shows the concept of mixing using static mixers. This video is 5.4 Mb and it will take about 1-2 minutes to upload if you are using a high-speed connection. If you are dialing up, you may want to skip this.

There will be more video clips of this type spread out in the various categories in

the Mixing Forum. Below are some jumping links to some of these clips, if you are only interested in static mixing. If you would like any assistance in applying static mixers to your process, please contact us.

- Turbulent mixing of two fluid streams: Miscible Liquids - Blending and Mixing Times
- Laminar mixing of two fluid streams:



Self cleaning mixers

[Home] [Up] [Mixing Definition] [Nomenclature] [Static Mixers] [Baffles] [Impellers] [Coils] [Tanks] [Macro Level Mixing] [Micro Level Mixing] [Phase Properties] [Scale-Up] [CFD & CFM] [Meetings] [Mixing Companies] [Literature]

Send mail to webmaster@postmixing.com with questions or comments about this web site.

Last modified: Apr. 10, 2004

June 11, 2004

Understanding Motionless Mixers

How they work, how they've evolved

Mughis Naqvi, P.Eng.
November 01, 2000

NOVEMBER 2000 – MIXING & BLENDING

Understanding Motionless Mixers

How they work, how they've evolved

By Mughis Naqvi, P.Eng.

Motionless mixers are low-shear, continuous in-line devices that can mix a large variety of materials to various consistencies.

Motionless mixers, also referred to as static mixers, generally rely on the sequential splitting of two components that must be mixed. The mixers are almost maintenance-free and do not rely on external power sources, except for the pump, to overcome pressure losses in the mixer.

Suitable for blending, dispersion and heat transfer, among other applications, the motionless mixer has garnered considerable interest from the chemical processing industry. The industry has a need for equipment that facilitates the uniform mixing of different fluid-type phases, powder- or granular-type materials, and combinations of fluids, gases and solids in continuous processes.

Spiral-geometry mixers

A particularly successful, yet simple, unit is the spiral-geometry mixer. The mixer has metallic or composite strips that are twisted, machined or injection-molded 180 degrees to form helical elements. These elements provide either right-hand or left-hand rotation. Alternate right- and left-hand elements then are joined so their respective leading and trailing edges are mutually perpendicular.

Spiral-type motionless mixer geometry is based on a design concept developed by Arthur J. Little in the 1960s. In the early 80s, the design was improved further by equipment companies to handle two-component high-viscosity applications. This design worked especially well in the adhesives and sealant industries.

Process streams entering the mixer are divided into numerous substreams as they spiral through the mixer. These substreams are recombined progressively and redivided between opposing baffles in an overlapping manner, making fluid channeling impossible. The number of flow divisions becomes very high, producing a mathematically predictable blend.

The spiral-geometry mixers' operation is relatively simple: If two fluids, A and B, are injected separately into the semicircular passage formed on either side of the first element, the physical constraint of the helix will cause the two streams to rotate as they flow along the tube.

In the first element, half of the total channel cross-section is filled with fluid A and the other with fluid B. Upon entering the second element, each semicircular stream is split as a result of the perpendicular orientation of adjacent elements. The two layers, A and B, flow in both passages of the second element. The flow then rotates in the opposite direction as a result of the left-handed orientation of the second helix.

This process is repeated at the interface between adjacent elements, so the number of layers of both fluids in each semicircular passage is doubled by each element. Therefore, a mixer containing six elements would produce 2^6 (64) alternate layers of fluids A and B in each semicircular passage when exiting the mixer, as expressed in Equation 1:

(1)

where:
d = the striation thickness;
D = the pipe's inner diameter;
2 = the number of splits in the stream;
N = the number of elements.

Motionless mixers vs. dynamic mixers

Motionless mixers fit right into the pipeline and consist of flanged ends, a piece of pipe and some twisted metal configurations to direct the mixing flow. Motionless mixers do not need to be plugged in, as do dynamic mixers, and so have lower capital and operating costs.

The horsepower required for a motionless mixer can be calculated by: 0.262 x pressure drop (psi) x flowrate (cfs).

Motionless mixers are plug-flow devices used in continuous operation; therefore, they have a greater tendency than dynamic mixers to plug up when mixing sludges, certain slurries and most fibers.

Motionless mixers have a uniformly controlled degree of flow and shear, whereas dynamic mixers have some backmixing with variations of flow and shear throughout the vessel, both near and far from the impeller.

The degree of mixing in a motionless mixer is dependent on the flowrate through the mixer. Increasing or reducing the flowrate will affect the degree of mixing. In a dynamic mixer, the impeller rpm always can be increased or decreased to adjust for a change in process conditions.

Motionless mixer operation

Motionless mixers operate on the principles of diffusion, convection and shear to achieve homogeneous blends.

Blending is a function of:

$$\text{Blending} = f\left\{Re, \mu, \frac{\mu_1}{\mu_2}, \frac{\rho_1}{\rho_2}, \frac{V_1}{V_2}, \nu, n, \frac{L}{D}, Inj\right\}$$

where:
Re = Reynolds number;
μ = absolute viscosity;
μ_1/μ_2 = viscosity ratio of unmixed streams;
ρ_1/ρ_2 = density ratio of unmixed streams;
V_1/V_2 = volumetric ratio of unmixed streams;
ν = shear rate;
n = number of elements;
L/D = element length-to-diameter ratio;
Inj. = injection method of additive stream.

The Reynolds number can be calculated by:

$$Re = 3{,}157\,\frac{Q \times sg}{\mu \times D} \quad (2)$$

where:
Q = flowrate (U.S. gpm);
sg = specific gravity;
μ = viscosity (cP);
D = pipe inner diameter (in.).

The number of mixing elements required in a motionless mixer can be calculated by determining the flow region, as calculated by the Reynolds number, shown in Table 1.

[illegible]		
Reynolds number	Number of spiral elements	Flow characteristics
<10	18	Laminar (creeping flow)
10 to 100	12	Laminar through transitional
100 to 1,000	6	Transitional
1,000 to 5,000	4	Turbulent
>5,000	2	Turbulent

The mixing and shear rates are determined by calculating the pressure drop across the motionless

mixer:

$$\Delta P_p = \frac{0.25 \times 10^{[illegible]} \times f \times l \times Q^2 \times \rho}{D^5} \quad (3)$$

where:

ΔP_p = pipe pressure drop (psi);
f = Darcy friction factor;
l = element length (in.).

The pressure drop across the mixer can be determined from the pressure drop across an empty pipe and the coefficient of friction caused by the motionless mixer elements:

$$\Delta P_M = \Delta P_P \times C_f \quad (4)$$

where:
P = empty pipe;
M = mixer;
C_f = coefficient of friction.

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Bibliography

Harnby, E.N. *Mixing in the Process Industries*, Butterworth Series, 1992, Chapter 12.
Latimer, R.J. and A. Amirtharajah. *Pilot Scale Comparison of Static Mixers and Backmix Reactors for Coagulation*, 1998 AWWA Annual Conference, Dallas. Texas.
McDonough, R.J. *Mixing for the Process Industries*, Van Nostrand Reinhold, New York, 1992 pp.158–173.
Oldshue, J.Y. *Fluid Mixing Technology*, McGraw-Hill, 1983, Chapter 19.

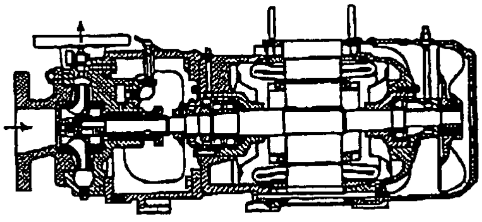


FIG. 10-38 Close-coupled pump.

Close-Coupled Pumps (Fig. 10-38) Pumps equipped with a built-in electric motor or sometimes steam-turbine-driven (i.e., with pump impeller and driver on the same shaft) are known as close-coupled pumps. Such units are extremely compact and are suitable for a variety of services for which standard iron and bronze materials are satisfactory. They are available in capacities up to about 450 m^3/h (2000 gal/min) for heads up to about 73 m (240 ft). Two-stage units in the smaller sizes are available for heads to around 150 m (500 ft).

Canned-Motor Pumps (Fig. 10-39) These pumps command considerable attention in the chemical industry. They are close-coupled units in which the cavity housing the motor rotor and the pump casing are interconnected. As a result, the motor bearings run in the process liquid and all seals are eliminated. Because the process liquid is the bearing lubricant, abrasive solids cannot be tolerated. Standard single-stage canned-motor pumps are available for flows up to 160 m^3/h (700 gal/min) and heads up to 76 m (250 ft). Two-stage units are available for heads up to 183 m (600 ft). Canned-motor pumps are being widely used for handling organic solvents, organic heat-transfer liquids, and light oils as well as many clean toxic or hazardous liquids or for installations in which leakage is an economic problem.

Vertical Pumps In the chemical industry, the term **vertical process pump** (Fig. 10-40) generally applies to a pump with a vertical shaft having a length from drive and to impeller of approximately 1 m (3.1 ft) minimum to 20 m (66 ft) or more. Vertical pumps are used as either **wet-pit pumps** (immersed) or **dry-pit pumps** (externally mounted) in conjunction with stationary or mobile tanks containing difficult-to-handle liquids. They have the following advantages: the liquid level is above the impeller, and the pump is thus self-priming; and the shaft seal is above the liquid level and is not wetted by the pumped liquid, which simplifies the sealing task. When no bottom connections are permitted on the tank (a safety consideration for highly corrosive or toxic liquid), the vertical wet-pit pump may be the only logical choice.

These pumps have the following disadvantages: intermediate or line bearings are generally required when the shaft length exceeds about 3 m (10 ft) in order to avoid shaft resonance problems; these

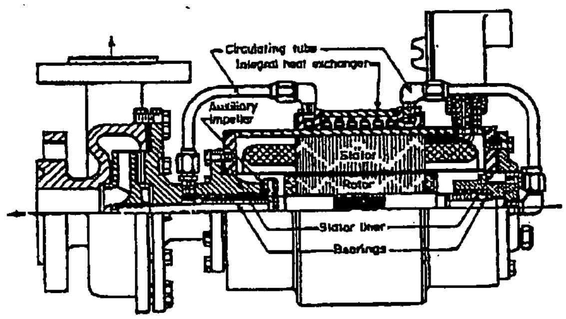


FIG. 10-39 Canned-motor pump (*Courtesy of Chempump Division, Crane Co.*)

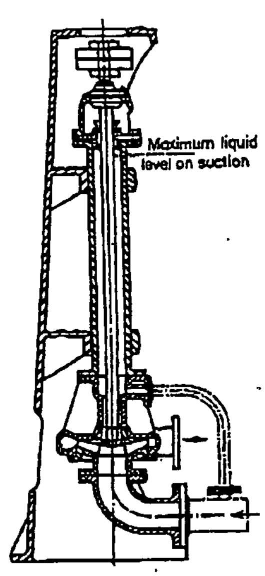


FIG. 10-40 Vertical process pump for dry-pit mounting. (*Courtesy of Lawrence Pumps, Inc.*)

bearings must be lubricated whenever the shaft is rotating. Since all wetted parts must be corrosion-resistant, low-cost materials may not be suitable for the shaft, column, etc. Maintenance is more costly since the pumps are larger and more difficult to handle.

For abrasive service, vertical cantilever designs requiring no line or foot bearings are available. Generally, these pumps are limited to about a 1-m (3.1-ft) maximum shaft length. Vertical pumps are also used to pump waters to reservoirs. One such application in the Los Angeles water basin has fourteen 4-stage pumps, each pump requiring 80,000 Hp to drive them.

Sump Pumps These are small single-stage vertical pumps used to drain shallow pits or sumps. They are of the same general construction as vertical process pumps but are not designed for severe operating conditions.

Multistage Centrifugal Pumps These pumps are used for services requiring heads (pressures) higher than can be generated by a single impeller. All impellers are in series, the liquid passing from one impeller to the next and finally to the pump discharge. The total head then is the summation of the heads of the individual impellers. Deep-well pumps, high-pressure water-supply pumps, boiler-feed pumps, fire pumps, and charge pumps for refinery processes are examples of multistage pumps required for various services.

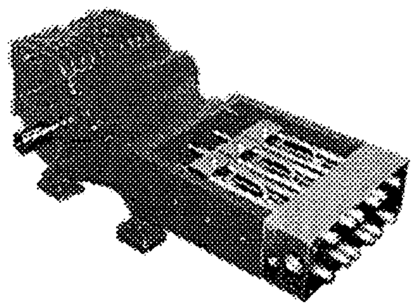
Multistage pumps may be of the **volute type** (Fig. 10-41), with single- or double-suction impellers (Fig. 10-42), or of the **diffuser type** (Fig. 10-43). They may have horizontally split casings or, for extremely high pressures, 20 to 40 MPa (3000 to 6000 lbf/in^2), vertically split barrel-type exterior casings with inner casings containing diffusers, interstage passages, etc.

PROPELLER AND TURBINE PUMPS

Axial-Flow (Propeller) Pumps (Fig. 10-44) These pumps are essentially very-high-capacity low-head units. Normally they are designed for flows in excess of 450 m^3/h (2000 gal/min) against heads of 15 m (50 ft) or less. They are used to great advantage in closed-loop circulation systems in which the pump casing becomes merely an elbow in the line. A common installation is for calandria circulation. A characteristic curve of an axial-flow pump is given in Fig. 10-45.

Back To Products

150J3W High Pressure Plunger Pump



Applications:

- Chemical Injection
- Oil Field Service
- API Processing
- Reverse Osmosis
- Mining
- Water Blasting

Pressures to 40,000 PSI
Flow Rates to 27 GPM

JETECH® 150J3W triplex plunger pump represents a new dimension of rugged versatility in high pressure pumping equipment. Designed to meet the demanding requirements of chemical injection, oil field, API processing, reverse osmosis, mining and water blasting applications, the pump is engineered to provide long dependable service and ease of field maintenance.

Liquid-End Features

JETECH® Advanced Design ("AD ") liquid-ends are precision-machined to exacting tolerances and feature segmented cylinders of the radial compression single-bore design. The radial compression single-bore feature eliminates undesirable bore intersections and cylinder tensile stresses which are known to be the major factors leading to pump cylinder failure.

Single-Spring Valves

JETECH®'s unique single-spring radial compression inline valve cartridge design eliminates the traditional discharge valve spring required in other plunger pumps. Since only one spring serves both suction and discharge valves, the single-spring feature effectively reduces the possibility of valve spring breakage up to 50% over two-spring units.

Plungers

The plungers are manufactured to exacting tolerances of nominal OD (+0.000) / (-0.001) inches. A choice of ceramic or **JETECH®**'s 060 NICKEL-CHROME-BORON fused hard coatings is available. Minimum coating thickness is 25 mils and minimum surface hardness is 60 Rc. Plungers are ground to a smooth surface finish of 8 RMS to provide long packing life.

Packing

The pump is designed to accommodate a broad spectrum of packing arrangements. The standard arrangement is the non-adjustable spring loaded style which can be fitted with vee, square, or **JETECH®** flat-backed chevron rings to withstand high pulsing loads.

Stuffing Boxes

The stuffing boxes of the **150J3W** pump are engineered as part of the segmented cylinders and are designed without radii. This important esign feature is essential to eliminate radii stress points which are the prime source of stuffing box cracking.

Power-End Features

Bearings

The main end bearings are the tapered roller design to withstand high loads. The crankshaft journal bearings are automotive type with steel backed inserts.

Maintenance Features

The liquid-ends of the **150J3W** pump offer many ease of maintenance features. The segmented liquid cylinders are held to a common manifold by four through manifold bolts that screw into a back cylinder holding plate. The removal of each cylinder is a simple task which requires only the unscrewing of the plunger from the pony rod and the removal of the four through-manifold bolts, which are accessible from the front side of the manifold. Packing, plunger, valves and cylinder changes can be accomplished in short time spans and do not require special skills of the workman. In fact, the valve cartridge can be removed from the pump without loosening the plunger or disturbing the packing. All that is required is to loosen the four through-manifold bolts and then slide the back of the cylinder approximately two inches toward the power-end. The valve cartridge can them be easily lifted from between the manifold and cylinder. This feature is great for quick suction and discharge valve inspection or component changing. When it comes to ease of field maintenance, no other through-bore type pump comes close to the exceptional versatility of the **150J3W** pump.

Specifications

Pump Model	Type	Plg.-Load Rating	Max. RPM	Stroke Length	Nominal Horsepower
150J3W	Triplex	10,000 Lbs.	500	3-3/4"	150

Valve Area - In^2			
UH - Cylinder		Super H - Cylinder	
Suct.	Disc.	Suct.	Disc.
0.123	0.079	0.28	0.15

Capacity

CAPACITY IN GPM - 100% VOLUMETRIC EFFICIENCY				
40k UH - CYLINDER				
PUMP SPEED	9/16" DIA. 40,000 PSI	5/8" DIA. 30,000 PSI	3/4" DIA. 20,000 PSI	7/8" DIA. 15,000 PSI
RPM	GPM	GPM	GPM	GPM
100	**1.20**	**1.50**	**2.15**	**2.92**

200	**2.40**	**3.00**	**4.30**	**5.85**
300	**3.60**	**4.50**	**6.45**	**7.78**
400	**4.80**	**6.00**	**8.60**	**11.68**
450	**5.40**	**6.70**	**9.70**	**13.20**
500	**6.00**	**7.50**	**10.70**	**14.70**

CAPACITY IN GPM - 100% VOLUMETRIC EFFICIENCY							
20k H - SUPER STANDARD CYLINDER							
PUMP SPEED	3/4" DIA. 20,000 PSI	7/8" DIA. 15,000 PSI	15/16" DIA. 13,000 PSI	1" DIA. 11,000 PSI	1-1/16" DIA. 10,000 PSI	1-1/8" DIA. 9,000 PSI	1-3/16" DIA. 8,000 PSI
RPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
100	**2.15**	**2.92**	**3.30**	**3.83**	**4.31**	**4.84**	**5.40**
200	**4.30**	**5.85**	**6.60**	**7.65**	**8.62**	**9.68**	**10.80**
300	**6.45**	**7.78**	**9.90**	**11.47**	**12.94**	**14.52**	**16.20**
400	**8.60**	**11.68**	**13.20**	**15.30**	**17.26**	**19.36**	**21.60**
450	**9.70**	**13.20**	**14.80**	**17.21**	**19.40**	**21.78**	**24.30**
500	**10.70**	**14.70**	**16.50**	**19.12**	**21.60**	**24.20**	**27.00**

BHP=GPMx PSI / 1542

Note: JETECH, Inc. reserves the right to alter the pump design without notice.

 info@jetech.com

Back To Products

Back To Products

MODEL 600G3
HIGH & ULTRA-HIGH PRESSURE PUMP

Pressures to 40,000 PSI
Flow Rates to 72 GPM

Performance Data

MAX. PRESSURE - PSI MAX. PRESSURE - BARS	20,000 1,380	14,500 1,000	10,800 747
PLUNGER SIZE - INCHES	1-1/4	1-1/2	1-3/4
RPM	LPM / GPM		
100	34 LPM 9 GPM	52 LPM 14 GPM	71 LPM 18 GPM
200	68 LPM 19 GPM	104 LPM 28 GPM	142 LPM 36 GPM
300	102 LPM 28 GPM	156 LPM 42 GPM	213 LPM 54 GPM
400	136 LPM 38 GPM	208 LPM 56 GPM	284 LPM 72 GPM

BHP = GPM X PSI / 1542

JETECH® pumps are available up to 1,400 horsepower covering a hydraulic pressure range up to 40,000 PSI and up to 650 GPM. All JETECH® Liquid Ends are available with the same positive design features as the 600G3

The JETECH® Model 600G3 High and Ultra-High Pressure Triplex Pump represents a new dimension of rugged versatility in high and ultra-high pressure pumping equipment.

The flow rate that is achieved by the Triplex pump is ideally suited for automated systems and multi-gun operation. Five (5) individuals simultaneously can easily perform different cleaning tasks off of one pump using JETECH® Hand Lances and Flow Splitters.

The unique JETECH® "AD" (Advanced Design) easy maintenance Liquid-End makes the 600G3 pumps the choice of operators world wide.

The Power-End of the pump incorporates a pressurized oil system and a heat exchanger that is designed into the rear cover plate.

The pump has a 6.0 inch (152.4 mm) stroke length.

Note: JETECH, Inc. reserves the right to alter the pump design without notice.

Back To Products

NOVAPLEX – Function, diaphragm pump heads, gears

For top reliability and operational security

NOVAPLEX pumps were conceived and designed for high security operation with the highest possible efficiency and flexibility.
The delivery rate is continuously variable from 0% to 100%, and operation is not affected by high suction pressures. The high overall efficiency reduces running costs.

Even under extreme loads, in continuous operation or with frequent start ups and variable load conditions, NOVAPLEX pumps deliver high accuracy, security and long life. They can be safely used in explosive atmospheres.

NOVAPLEX pumps consist of individual units (pump head and gear) which can be combined with a drive and extended to multiple pump assemblies **up to seven units.** The pump diaphragms are available in PTFE or stainless steel.

Leak-proof diaphragm pump heads

Bran+Luebbe supplies a comprehensive range of hydraulically actuated diaphragm pump heads for all gear sizes. The flow rates range from a few hundred litres per hour to over 50 m³/h at pressures up to 700 bar and temperatures from −20°C to +150°C.

Advantages of double-diaphragm design

High operating security

- **Patented diaphragm position control system** protects the diaphragm from overload and increases its life.
- **Diaphragm condition monitoring system** signals the onset of wear or damage. Delivery performance is maintained until the diaphragm is changed.
- **Pressure limiting valve** protects the pump against damage from excessive pressure in the production process.
- **Starting** against process pressure without run-up assistance.

Security for product and environment

- **Multi-layer diaphragm** protects the pumped liquid from contamination
- **Leak-proof** hermetically sealed pump head protects operators and environment against aggressive or toxic product

Diaphragm pump technology

The plunger movement is transmitted to the freely moving membrane via hydraulic fluid.
The membrane forms a hermetic seal which separates the hydraulic fluid from the pumped liquid.
The patented diaphragm position control system protects the double-diaphragm from overload, extending its life and reducing running costs.
The average diaphragm life can exceed 20000 operating hours.

Equipped to your requirements

Pump head technology

- Hydraulically actuated **PTFE double-diaphragm** (up to 400 bar)
- Hydraulically actuated **stainless steel double-diaphragm** (up to 700 bar)
- Pump head and valve housing in **stainless steel. Special materials** available for individual applications
- Suction and discharge valves in **various geometries** with or without spring loading

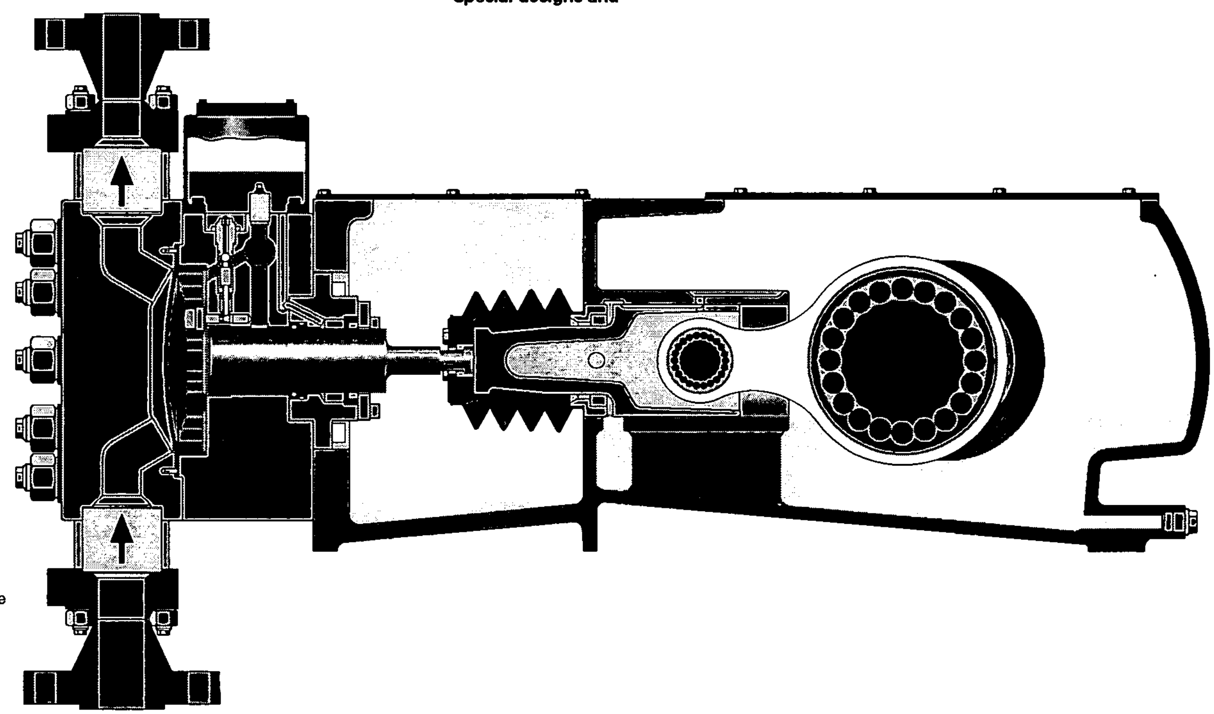
Special designs and materials available **for valve heads** for low NPSH application

Robust gears in modular design

The modular conception of NOVAPLEX pumps allows multiplex pumps with up to 7 units.

All bearings are fitted with roller bearings. This ensures long life even under extreme operating conditions. High suction pressures, infinitely variable rotation speed from zero to maximum, frequent start ups or continuous operation at low speed are no problem.

Gears use the well-proven immersion lubrication principle for complete reliability.



- Process liquid
- Hydraulic fluid under variable pressure
- Atmospheric pressure
- Lubrication oil

BRAN+LUEBBE

A United Dominion Company

Free choice of drives

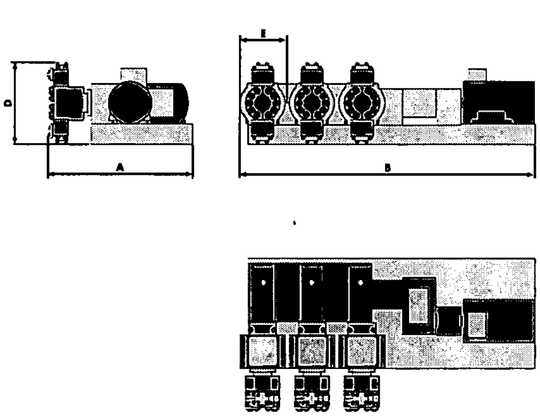
A further advantage of the modular concept is that all types of drive, including electric motors, combustion engines and hydraulic drives can be freely used.

The positioning of the drive depends on individual installation requirements and is to customer specification. Different gears are available, including bevel or angled types.

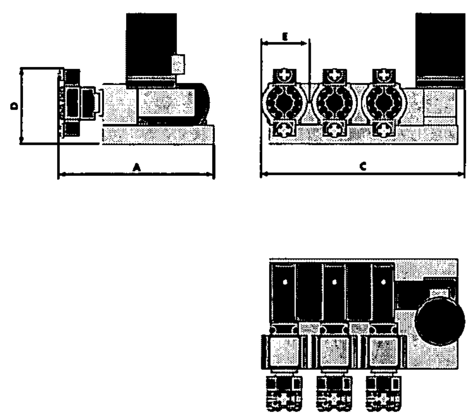
The flow rate is steplessly adjustable via the rotation speed of the drive. Asynchronous AC motors with frequency converters are particularly economical, but other types of speed regulation may also be used.

Layout and dimensions

Example: Triplex version



Horizontal motor position with spur gear



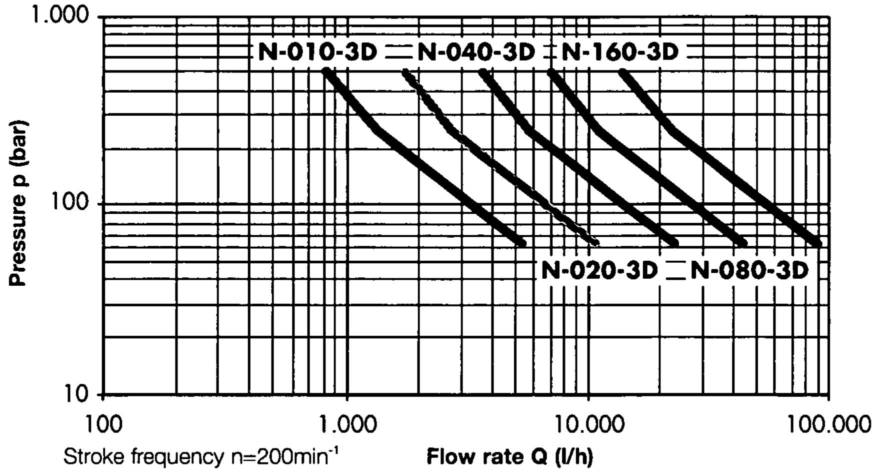
Vertical motor position with angular gear

Main dimensions in mm*

NOVAPLEX	A	B	C	D	E
N-010-3D	1100	2000	1400	700	370
N-020-3D	1200	2500	1800	800	410
N-040-3D	1600	3000	2100	1000	520
N-080-3D	2000	3700	2700	1200	660
N-160-3D	2200	4400	3300	1300	820

* Dimensions are reference figures only. Exact dimensions depend on the size of pump head, motor and gear.

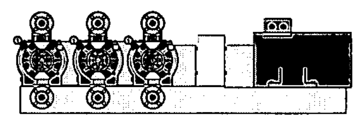
Characteristics NOVAPLEX process pumps with PTFE-diaphragm

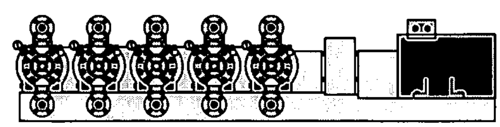


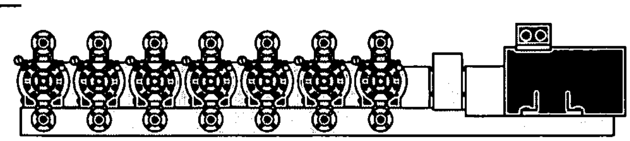
Examples of NOVAPLEX pump combinations

Three to seven pump units may be combined.

Type	Nominal pressure	Plunger Ø	Flow rate Q* Triplex	Quintuplex	Septuplex
	bar	mm	l/h	l/h	l/h
010	400	22	821	1368	1915
	250	28	1330	2216	3103
	160	36	2198	3664	5130
	100	45	3435	5725	8016
	63	56	5320	8867	12413
020	400	32	1737	2895	4053
	250	40	2714	4524	6333
	160	50	4241	7068	9896
	100	63	6733	11222	15711
	63	80	10857	18096	25334
040	400	36	3664	6107	8550
	250	45	5725	9542	13360
	160	56	8867	14778	20689
	100	70	13854	23091	32327
	63	90	22902	38171	53440
080	400	50	7068	11781	16493
	250	63	11222	18704	26185
	160	80	18096	30160	42224
	100	100	28275	47125	65975
	63	125	44180	73633	103086
160	400	63	14028	23380	
	250	80	22620	37700	
	160	100	35344	58906	
	100	125	55225	92041	
	63	160	90480	150801	


Triplex process pump


Quintuplex process pump


Septuplex process pump

* Volumetric efficiency η = 100%, stroke frequency n = 200min^{-1}
Note: Allow for liquid transmission losses.